

Remarks

In view of the above amendments and the following remarks, reconsideration of the objections and rejections, and further examination are requested.

The Applicant acknowledges that claims 1-4 and 6-16 are withdrawn from further consideration. Claims 1-4 and 7-16 have, therefore, been cancelled without prejudice or disclaimer of the subject matter contained therein.

The title of the specification has been objected to in the Office Action. More specifically, the Examiner asserts that the title should be revised to reflect the claimed method invention. Therefore, the title has been amended to “A method of manufacturing a speaker using an insertion jig”.

The abstract has been objected to in the Office Action. More specifically, the Examiner asserts that the abstract should be modified to read on the claimed method. Therefore, the abstract has been amended to reflect the subject matter recited in claim 5.

For at least the reasons set forth above, the Applicant respectfully requests that the objections to the specification and abstract be withdrawn.

Further, the specification and abstract have been carefully reviewed and revised to make grammatical and idiomatic improvements in order to aid the Examiner in further consideration of the application. A substitute specification and abstract including the revisions have been prepared and are submitted herewith. No new matter has been added. Also submitted herewith are marked-up copies of the substitute specification and abstract indicating the changes incorporated therein.

The drawings have been objected to in the Office Action. More specifically, the Examiner asserts that Figures 3-5 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. Submitted herewith are replacement Figures 3-5 that have been amended to contain the label “Prior Art”. No new matter has been added by these revisions.

For at least the reasons set forth above, the Applicant respectfully requests that the drawing objections be withdrawn.

Claim 5 has been rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the Applicant

regards as the invention. More specifically, the Examiner asserts that claim 5 is directed to both a method of manufacturing a speaker and the structural elements of an operatively associated jig, which make the claim's scope unclear. Claim 5 has been amended to include most of the suggestions kindly provided by the Examiner. Therefore, the Applicant respectfully submits that claim 5, as amended, satisfies 35 U.S.C. § 112, second paragraph.

For at least the reasons set forth above, the Applicant respectfully requests that the 35 U.S.C. § 112, second paragraph, rejection of claim 5 be withdrawn.

Claim 5 has been rejected under 35 U.S.C. § 102(b) as being anticipated by Masahito (JP 2001-045599).

Claim 5 has been amended as to further distinguish the present invention, as recited therein, from the references relied upon in the above mentioned rejection.

Moreover, claims 5 and 6 have been amended so as to make a number of editorial revisions thereto. These revisions have been made to place the claim in better U.S. form. None of these amendments have been made to narrow the scope of protection of the claims, or to address issues related to patentability, and therefore, these amendments should not be construed as limiting the scope of equivalents of the claims which are offered by the Doctrine of Equivalents.

The above-mentioned rejection is submitted to be inapplicable to the amended claims for the following reasons.

Claim 5 recites a method of manufacturing a speaker using a voice coil insertion jig including, in part, providing a voice coil insertion jig having an insertion part and a plurality of movable pieces that define an outside diameter that is larger than an outside diameter of the insertion part and a central boss provided above a center of an upper surface of a base that is separate from the movable pieces, deforming the plurality of movable pieces elastically toward the central boss, and inserting the voice coil insertion jig into a voice coil, and causing the plurality of moving pieces to elastically contact with and hold the voice coil with the voice coil insertion jig.

In contrast, Masahito discloses a voice coil holder 19 for a voice coil bobbin 16 that is structured to be elastically displaced inward. More specifically, the voice coil holder 19 includes

an insertion part 32 and a segmented base 39 that is divided into three segments by gaps 38. The insertion part 32 has a constant diameter and extends from a terminus of the gaps 38 at 112 to a bottom 31 of the voice coil holder 19. Further, each of the segments of the base 39 is coupled to a boss comprised of members 36 and 37. Moreover, each of the segments of the base 39 includes a movable member extending from a bottom thereof to the terminus of the gaps 38 at 112.

During the use of the voice coil holder 19, the movable members are elastically displaced such that they together necessarily define a diameter that is less than or equal to (see Figures 2a and 4b) the diameter of insertion part 32, and such that each segment of the base 39 and the corresponding bosses, comprised of the members 36 and 37, also move. The voice coil holder is then inserted into the voice coil bobbin 16. Further, to separate the voice coil holder 19 from the voice coil bobbin 16, the movable members are again elastically displaced and the voice coil holder 19 is extracted from the voice coil bobbin 16.

Based on the above discussion, it is apparent that the voice coil holder 19 of Masahito includes movable members that together define a diameter that is less than or equal to the diameter of the insertion part 32, and such that each segment of base 39 and corresponding bosses, comprised of the members 36 and 37, also move. However, there is no disclosure in Masahito that the bosses, comprising the members 36 and 37, are separate from their respective segmented bases 39 and the movable members, and that the movable members define an outside diameter that is larger than the outside diameter of the insertion part 32. In other words, Masahito does not disclose or suggest providing a voice coil insertion jig having an insertion part and a plurality of movable pieces that define an outside diameter that is larger than an outside diameter of the insertion part, and a central boss provided above a center of an upper surface of a base that is separate from the movable pieces, deforming the plurality of movable pieces elastically toward the central boss, and inserting the voice coil insertion jig into a voice coil, and causing the plurality of moving pieces to elastically contact with and hold the voice coil with the voice coil insertion jig.

For the above reasons, it is believe clear that Masahito fails to disclose or suggest the present invention as recited in claim 5.

Further, claim 5 has been rejected under 35 USC 103(a) as being unpatentable over Masahito in view of the Applicants admitted prior art (APA). However, this rejection is also submitted to be inapplicable for the following reasons.

Based on the above discussion of Masahito, it is apparent that the voice coil holder 19 of Masahito includes moving members that elastically displace such that they together define a diameter that is less than or equal to the diameter of insertion part 32, and such that each segment of base 39 and corresponding bosses, comprised of members 36 and 37, also move. However, Masahito does not disclose or suggest a method of manufacturing a speaker using a voice coil insertion jig including, in part, providing a voice coil insertion jig having an insertion part and a plurality of movable pieces that define an outside diameter that is larger than an outside diameter of the insertion part, and a central boss provided above a center of an upper surface of a base that is separate from the movable pieces, deforming the plurality of movable pieces elastically toward the central boss, and inserting the voice coil insertion jig into a voice coil, and causing the plurality of moving pieces to elastically contact with and hold the voice coil with the voice coil insertion jig. Therefore, APA must disclose or suggest these features in order for the combination of Masahito and APA to render the present invention as recited in claim 5 obvious.

Regarding APA, it is relied upon in the rejection as disclosing inserting the voice coil insertion jig into a magnetic gap forming a magnetic circuit of the speaker. However, it is clear that APA also fails to disclose or suggest the above disclosed features of the method of manufacturing a speaker using a voice coil insertion jig as recited in claim 5. Therefore, APA fails to address the deficiencies of Masahito. As a result, claim 5 is patentable over the combination of Masahito and APA.

Regarding withdrawn claim 6, it is noted that claim 6 is dependent from claim 5. Therefore, because claim 5 is allowable, claim 6 is entitled to due consideration.


Because of the above-mentioned distinctions, it is believed clear that claims 5 and 6 are patentable over the references relied upon in the rejections. Furthermore, it is submitted that the distinctions are such that a person having ordinary skill in the art at the time of invention would not have been motivated to make any combination of the references of record in such a manner, as to result in, or otherwise render obvious, the present invention as recited in claims 5 and 6.

In view of the foregoing amendments and remarks, all of the claims now active in this application are believed to be conditions for allowance. Reconsideration and favorable action is respectfully solicited.

Should the Examiner believe there are any remaining issues which must be resolved before this application can be passed to issue, it is respectfully requested that the Examiner contact the undersigned by telephone in order to solve such issues.

Respectfully submitted,

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A METHOD OF MANUFACTURING A SPEAKER USING AN INSERTION

JIG DESCRIPTION

VOICE COIL INSERTION JIG, MANUFACTURING

METHOD OF LOUDSPEAKER USING THE SAME JIG, AND

LOUDSPEAKER MANUFACTURED BY USING THE SAME JIG

BACKGROUND OF THE INVENTION

(1) Field of the Invention ~~TECHNICAL FIELD~~

The present invention relates to a voice coil insertion jig used in manufacturing ~~manufacture~~ of speakers that are incorporated in various acoustic appliances, a manufacturing ~~manufacture~~ method of manufacturing ~~manufacture~~ a speaker using this jig, and a speaker manufactured by using this jig.

(2) Description of Related Art ~~BACKGROUND ART~~

The A ~~A~~-prior art is explained by referring to Figures 3 to 5 ~~Fig. 3 to Fig. 5~~. Figure 3 ~~Fig. 3~~ is a sectional view of a speaker, Figure 4 ~~Fig. 4~~ is a perspective exploded view of a voice coil assembling jig used when assembling the speaker ~~same~~, and Figure 5 ~~Fig. 5~~ is a sectional view illustrating ~~explaining~~ the assembling process of the voice coil.

A structure of a speaker is described in Figure 3 ~~Fig. 3~~. Magnetic circuit 1 is composed of a ~~a~~ lower plate 1a having a ~~a~~ center pole 1b, a ~~a~~ magnet 1c coupled on a ~~a~~ lower plate 1a, and an ~~an~~ upper plate 1d coupled on magnet 1c. Magnetic circuit 1 has a ~~a~~ magnetic gap 1e between upper plate 1d and center pole 1b. A frame ~~Frame~~ 2 is coupled to upper plate 1d. A diaphragm ~~Diaphragm~~ 3 is coupled to frame 2 by way of an ~~an~~ edge 3a formed on an ~~the~~ outer circumference of diaphragm ~~diaphragm~~ 3. A voice ~~Voiee~~ coil 4 is composed of a ~~a~~ coil 4a and a ~~a~~ bobbin 4b. Coil 4a is inserted in magnetic gap

1e, and ~~an the~~ internal circumference of diaphragm 3 is coupled to a specified position of bobbin 4b. ~~An The~~ outer circumference of damper 5 is coupled to frame 4, and ~~an its~~ inner circumference of damper 5 is coupled to bobbin 4b. In this constitution, voice coil 4 is supported movably up and down.

5 In the manufacturing process of such a speaker, what requires the highest precision is the inserting process of voice coil 4 into magnetic gap 1e.

A conventional voice coil insertion jig disclosed in Japanese Laid-open Utility Model No. 57-160292 is explained by referring to Figures 4 and 5~~Fig. 4 and Fig. 5~~. The conventional voice coil insertion jig is composed of a jig main body 11, a gauge tube 12, a slit 13, and a spring 14.

Spring 14 is assembled into ~~an the~~ inside of jig main body 11, and generates a force for opening slit 13. The insertion jig is inserted into bobbin 4b while closing slit 13, and after positioning, voice coil 4 is fixed by the pressure of spring 14. Together with the jig, ~~the~~ voice coil 4 is inserted into center pole 1b of magnetic circuit 1. ~~That 4, that is,~~ voice coil 4 is inserted into magnetic gap 1e. At this time, depending on the material thickness of gauge tube 12, the position of voice coil 4 in the radial direction is defined. In this state, frame 2 is adhered and coupled to magnetic circuit 1. (Frame 2 may be first adhered and coupled to magnetic circuit 1.) After adhering damper 5 and diaphragm 3 to frame 2 and bobbin 4b, the insertion jig is pulled out of the speaker. Finally, dust cap 6 is adhered and coupled to diaphragm 3, and the speaker is manufactured.

Thus, in the speaker manufacturing process, the voice coil insertion jig is required to have a high precision for positioning voice coil 4.

As the appliance is reduced in size recently, a speaker of small size and high efficiency is demanded. For this purpose, magnetic gap 1e is required to be much

narrower.

BRIEF SUMMARY OF THE INVENTION **DISCLOSURE OF THE INVENTION**

5 It is hence an object of the invention to solve the above problem, and present a voice coil insertion jig for realizing a speaker of high performance with a narrower magnetic gap by enhancing the positioning precision of the voice coil in the magnetic gap, a ~~manufacturing~~ method of manufacturing a speaker using the jig ~~same~~, and a speaker manufactured by using the jig ~~same~~.

10 In one aspect of the invention, a ~~The~~ voice coil insertion jig ~~of the invention~~ ~~comprises the following:~~includes

a base;

— a hollow cylindrical insertion part provided integrally in a ~~the~~ lower part of the base, and ~~base~~;

15 — a plurality of moving pieces provided integrally in an ~~the~~ upper part of the base, the outside diameter being formed the plurality of moving pieces being larger than the outside diameter of the insertion part. The voice coil insertion jig also includes ~~part; and~~

a central boss, boss provided above a ~~the~~ center of the base, that is separate ~~being apart~~ from the moving pieces, such that the plurality of moving pieces elastically contacts ~~contacting with~~ and holds ~~holding~~ the voice coil.

In another aspect of the invention, a ~~A~~ ~~manufacturing~~ method of manufacturing a speaker using a ~~of the invention~~ ~~uses the~~ voice coil insertion jig ~~composed as shown above, and comprises the steps of:~~includes

25 — a) deforming a plurality of moving pieces elastically to a ~~the~~ central boss side,

and inserting the moving pieces into a voice coil, ~~coil~~;

——b) restoring the elastic deformation, and holding the voice coil in a voice coil insertion jig, ~~jig~~;

——e) inserting the voice coil insertion jig ~~holding the voice coil~~ into a magnetic gap forming a magnetic circuit, and circuit;

——d) adhering an ~~the~~ inner circumference of a diaphragm to the voice coil, and adhering an ~~the~~ outer circumference of the diaphragm to a frame. The method also includes frame; and

——e) deforming the plurality of moving pieces elastically to the central boss side, and extracting the voice coil insertion jig from the magnetic gap.

Thus, the ~~The~~ speaker of the invention is manufactured ~~in this manufacturing method~~ using the voice coil insertion jig composed as described above.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1A ~~Fig. 1A~~ is a top view of a preferred embodiment of voice coil insertion jig of the invention.

Figure 1B ~~Fig. 1B~~ is a sectional view along section line of A-O-B of Figure 1A ~~side in Fig. 1A~~.

Figure 1C ~~Fig. 1C~~ is a bottom view of the voice coil insertion jig ~~same~~.

Figure 2A ~~Fig. 2A~~ is a top view of another ~~other~~ preferred embodiment of the voice coil insertion jig of the invention.

Figure 2B ~~Fig. 2B~~ is a sectional view along section line of A-O-B of Figure 2A ~~side in Fig. 2A~~.

Figure 2C ~~Fig. 2C~~ is a bottom view of the voice coil insertion jig shown in Figure 2A ~~same~~.

Figure 3 ~~Fig. 3~~ is a side sectional view of a speaker.

Figure 4 ~~Fig. 4~~ is a perspective exploded view of voice coil assembling jig used in assembling of the speakers~~same~~.

Figure 5 ~~Fig. 5~~ is a sectional view illustrating ~~explaining~~ the assembling
5 process of the voice coil.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of a voice coil insertion jig of the invention are described below with reference ~~while referring to~~ Figures 1A through 2C and Figure
10 3~~Fig. 1A to Fig. 2C and Fig. 3~~. It should be understood that parts described in the
preferred embodiments that are also included in ~~Same parts as in the description of~~
the prior art are identified with same reference numerals, and the explanation is omitted.

(Preferred embodiment 1)

15 Figure 1A ~~Fig. 1A~~ is a top view of a preferred embodiment of a voice coil insertion jig. Figure 1B~~Fig. 1B~~ is a sectional view along section line of A-O-B
side of Figure 1A. Figure 1C ~~in Fig. 1A, and Fig. 1C~~ is a bottom view of the voice
coil insertion jig~~same~~.

A voice ~~Voice~~ coil insertion jig 20 is composed of a base 20a, a hollow
20 cylindrical insertion part 20b provided in a ~~its lower part~~ part of base 20a, a plurality
of moving pieces 20c, and a central boss 20d. The plurality ~~Plurality~~ of moving
pieces 20c are provided integrally in an ~~the~~ upper part of base 20a, are separate
being apart from each other, and each include an ~~the~~ outer circumference is formed
as an arc of a nearly the same circumference. A ~~The~~ diameter in the upper parts of
25 each of the plurality of moving pieces 20c is constant, and the diameter is smaller in

~~the lower parts of each of the plurality of moving pieces 20 because parts, that is, a~~
 slope is provided. Central boss 20d disposed apart from moving pieces 20c is
 formed so as to extend upward from ~~a the~~ center of base 20a. ~~An The~~ outer
 circumference of central boss 20d is opposite to each of the plurality of moving
 5 pieces 20c across a specified gap.

Each of moving piece ~~Moving piece~~ 20c has a horizontal slit 20e at a its lower
 outer side thereof. Moving pieces 20c are formed integrally in base 20a and are
 separated from each other by a vertical slit 20f.

Slit 20f is formed for reducing an the outside diameter formed by moving
 10 pieces 20c when inserting voice coil insertion jig 20 into voice coil 4, or when
 extracting voice coil insertion jig 20 from voice coil 4. Therefore, the width of slit
 20f is not particularly defined as far as moving pieces 20c can be inclined for an
 inserting and extracting process (it is further preferred to set the slit width to such an
 extent that moving pieces 20c may not be inclined over the limit of elasticity for the
 15 sake of the inserting and extracting process).

A diameter ~~Diameter~~ d1 of an outer circumference of base 20a and of insertion
 part 20b, and a diameter d2 formed by upper parts of moving pieces 20c in an
 ordinary state are such that in the relation of $d2 > d1$. ~~A The~~ diameter of an outer
 circumference formed by ~~the lowest end parts of the outer~~ sides ~~side~~ of moving
 20 pieces 20c is set nearly at d1, and ~~this~~ d1 is set to be equal to an the inner
 circumference of voice coil 4. As shown in Figure 1A ~~clear from Fig. 1A~~, moving
 pieces 20c include an inner wall side that is ~~are~~ polygonal (tetragonal in the
 preferred embodiment) such that an angle is provided to facilitate defining at the
~~inner wall side, and its the apex,~~ vertical slit 20f is ~~formed as stated above~~. ~~A The~~
 25 ~~slit~~ width of vertical slit 20f represents an the interval of mutually opposing sides of

moving pieces 20c.

Central boss 20d is formed longer than moving pieces 20c, and it is used as a knob in the working process.

Magnetic gap 1e between voice coil 4 and magnetic circuit 1 is assured by the thickness of insertion part 20b. An ~~(The~~ outer circumference of center pole 1b of magnetic circuit 1 and an ~~the~~ inner circumference of insertion part 20b are nearly equal, and only a slight allowance for insertion during assembling process is provided. Moreover, an ~~provided, and the~~ interval between the outer circumference of center pole 1b and voice coil 4 is assured by a ~~the~~ thickness of insertion part 20b, and hence an interval between upper plate 1d and voice coil 4 is also assured.)

A method of assembling ~~An assembling method~~ of a speaker is explained.

By pushing moving pieces 20c of voice coil insertion jig 20 to the inner side to deform within an elastic deforming range, voice coil insertion jig 20 is inserted into voice coil 4. After inserting jig 20 up to a specified position, the inward pushing force applied to moving pieces 20c is released. As a result, moving pieces 20c elastically contact with the inner side of voice coil 4 in the restoring process. Thus, voice coil 4 is held in voice coil insertion jig 20.

While holding voice coil 4, insertion part 20b is fitted into center pole 1b of magnetic circuit 1, preliminarily adhered and coupled to frame 2, and inserted into magnetic gap 1e.

In succession, damper 5 and diaphragm 3 are adhered to frame 2 and coil bobbin 4b as shown in Fig. 3. Then, with moving pieces 20c being pushed to the central boss side, insertion jig 20 is pulled out. Finally, dust cap 6 is adhered to diaphragm 3.

In this manner, by using voice coil insertion jig 20 of the preferred

embodiment, positioning and fixing of voice coil 4, and handling when assembling the speaker can be done easily by using moving pieces 20c and central boss 20d, so that the working efficiency can be enhanced.

Further, since insertion part 20b does not have slit 13 as in the prior art, but is
5 a hollow tube, deformation of voice coil 4 can be prevented.

Moreover, magnetic gap 1e depends only on the thickness of this insertion part 20b, so that magnetic gap 1e is assured to remain constant~~can be assured stably~~. Hence, magnetic gap 1e can be narrowed, ~~and the magnetic efficiency is enhanced,~~ and a higher output is realized, while the magnetic circuit is reduced in size and the
10 speaker is reduced in weight~~weight of the speaker can be also reduced~~.

In the preferred embodiment, a speaker having damper 5 is explained, but it can be similarly applied to a speaker without a damper.

(Preferred embodiment 2)

~~An alternate~~Other preferred embodiment of the invention is explained by
15 referring to a top view of ~~the other preferred embodiment~~ of voice coil insertion jig 20 as shown in Figure 2A~~in Fig. 2A~~, a sectional view along sectional line of A-O-B
in Figure 2B~~side of Fig. 2A in Fig. 2B~~, and a bottom view of jig 20 as shown in Figure 2C. It should be understood that parts described in the preferred embodiment
that are also included in the alternate embodiment~~the same in Fig. 2C~~. In the
20 ~~following explanation, same parts as in preferred embodiment 1~~ are identified with same reference numerals, and the explanation is omitted.

Only different points from the preferred embodiment 1 are described below. A first different point is that center pin 20g is provided in insertion part 20b. Center pin 20g is formed downward in the center of base 20a. In a~~the~~ center of center pole
25 1b, a center pole hole (not shown) for inserting center pin 20g is formed. In the

manufacturing process, by inserting center pin 20g into the center pole hole ~~formed in center pole 1b~~, voice coil 4 is positioned.

As a result, in contrast to the preferred embodiment ~~same as in preferred embodiment 1~~, it is not required to position voice coil 4 by defining the outer
 5 circumference of center pole 1b to be substantially the same as the diameter of inner circumference of insertion part 20b. Moreover, ~~as much as possible, and by~~ inserting center pin 20g, it is easier to position voice coil 4 than in the preferred
 embodiment 1, and ~~also~~ voice coil 4 can be positioned without depending on the diameter of center pole 1b. Consequently, jig 20 1b, ~~so that the jig~~ can be managed
 10 easily without preparing insertion jig 20 for the portion of difference in outside diameter of center pole 1b.

INDUSTRIAL APPLICABILITY

As described herein, the invention presents a voice coil insertion jig capable of
 15 assembling a speaker at excellent working efficiency and high precision without deforming the voice coil, a manufacturing method using the jig same, and a speaker manufactured by this method.

ABSTRACT

~~A voice coil insertion jig is composed of hollow cylindrical insertion part 20b formed in the lower part of a base for inserting a magnetic circuit, a plurality of moving pieces formed thereon, and a central boss provided above the base. The moving pieces elastically contact with and hold the inserted voice coil. The central boss function as a knob.~~

A method of manufacturing a speaker using a voice coil insertion jig including providing a voice coil insertion jig, deforming a plurality of moving pieces from a first position elastically toward a central boss side to a second position, inserting the voice coil insertion jig into a voice coil, and restoring the plurality of moving pieces to the first position and holding the voice coil using the plurality of moving pieces. Moreover, the method includes inserting the voice coil insertion jig into a magnetic gap forming a magnetic circuit of the speaker, adhering an inner circumference of a diaphragm of the speaker to the voice coil, adhering an outer circumference of the diaphragm to a frame of the speaker, and deforming the plurality of moving pieces elastically from the first position from toward the center boss side to the second position and extracting the voice coil insertion jig from the magnetic gap.